Executive Forum on Modeling & Simulation 2001
31 May 2001

Modeling & Simulation Executive Agent Panel

PRESENTER
RICHARD W. SPINRAD, PhD.
TECHNICAL DIRECTOR
OFFICE OF THE OCEANOGRAPHER OF THE NAVY
OCEAN EXECUTIVE AGENT

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (FROM - TO)
30-05-2001	Briefing	xx-xx-2001 to xx-xx-2001

4. TITLE AND SUBTITLE
Modeling & Simulation Executive Agent Panel
Unclassified

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Spinrad, Richard W. ;

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME AND ADDRESS
Office of the Oceanographer of the Navy
xxxxx, xxxxxxx

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS
United States Department of Defense
Defense Modeling and Simulation Office
1901 N. Beauregard St., Suite 500
Alexandria, VA22311-1705

10. SPONSOR/MONITOR'S ACRONYM(S)
11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APUBLIC RELEASE
,

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Three Primary Mission Areas ? Safety of the Fleet and the Navy Shore Establishment ? Application of Meteorology and Oceanography (METOC) to optimizing performance of Navy Platforms, Weapon Systems, and Sensors ? Application of Geospatial Information and Services (GI&S) and Precise Time and Astrometry (PTA) Data to Navigation, Communications, and Targeting Systems

15. SUBJECT TERMS

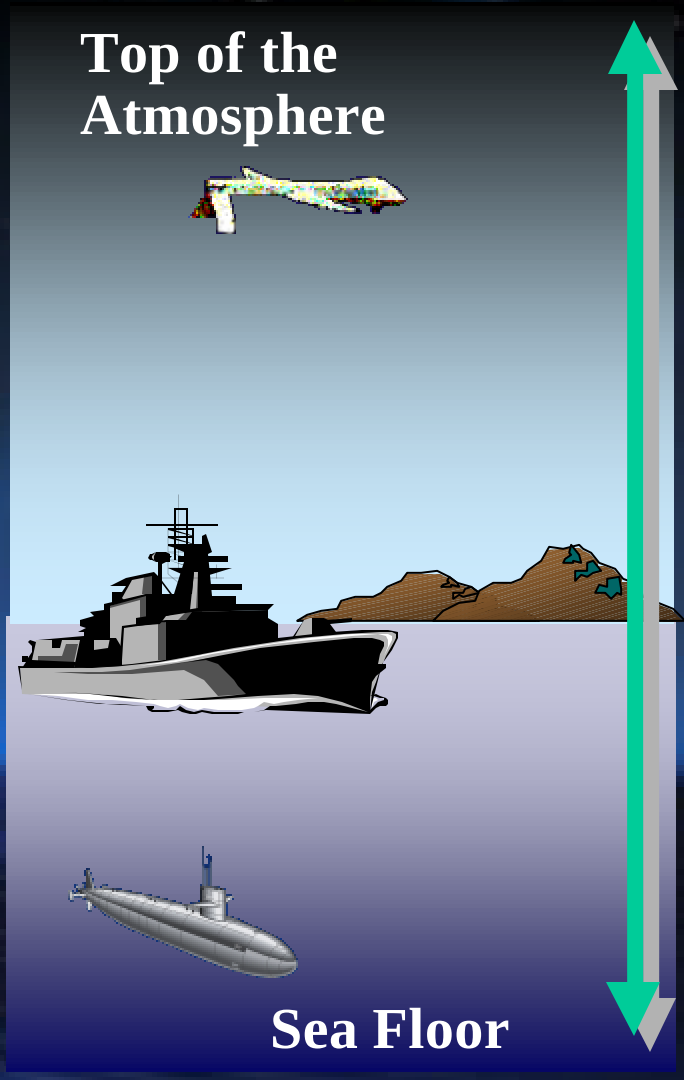
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE	Public Release	29	Fenster, Lynn lfenster@dtic.mil
Unclassified	Unclassified	Unclassified			19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007

Three Primary Mission Areas

- **Safety of the Fleet and the Navy Shore Establishment**
- **Application of Meteorology and Oceanography (METOC) to optimizing performance of Navy Platforms, Weapon Systems, and Sensors**
- **Application of Geospatial Information and Services (GI&S) and Precise Time and Astrometry (PTA) Data to Navigation, Communications, and Targeting Systems**

Community Size & Scope

< 0.4%
Navy TOA



Assets:

Almost 3300 Total End Strength

8 Military Survey Ships

9 Major Activities

Almost $400M Total Resources

$36M R&D (6.4 & 6.5)

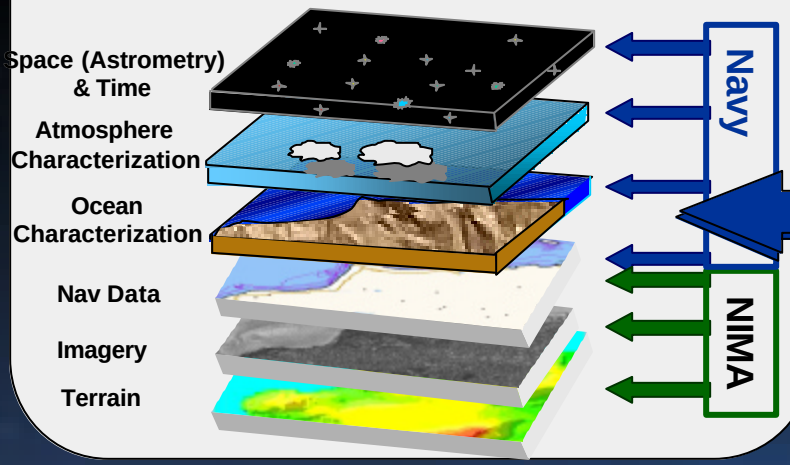
METOC Concepts

- **Overarching Theme:**
  - *Network-Centric METOC Operations*

- **Common METOC Picture**
  - 4-D Cube supporting COP/CTP
- **Collection of METOC Data in Denied Areas**
- **Rapid Environmental Assessment (REA)**
- **Through the Sensor Data Collection**

The 4-D "Cube"

Feature Foundation Data (Static Characterization)



Military Survey Ships (*Existing*)

Data Management

METOC Center

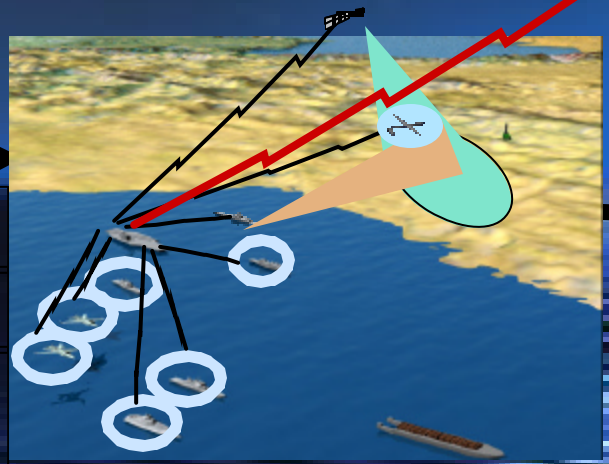
Common Operational Picture

Mission Planning Systems

Weapon Systems

Multi-Mission Support Ship (*Future*)

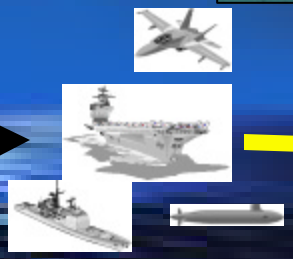
Rapid Environmental Assessment



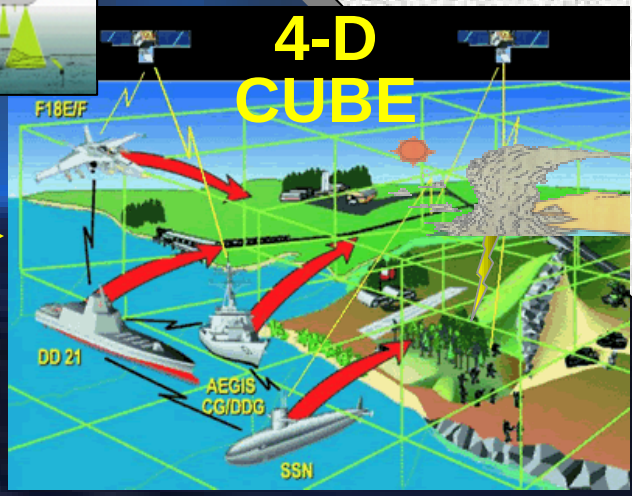
Thru The Sensor Data

Dedicated sensors

On scene processing & delivery



Force and Threat Data



Dynamic Nowcast/Forecast

Our Goal

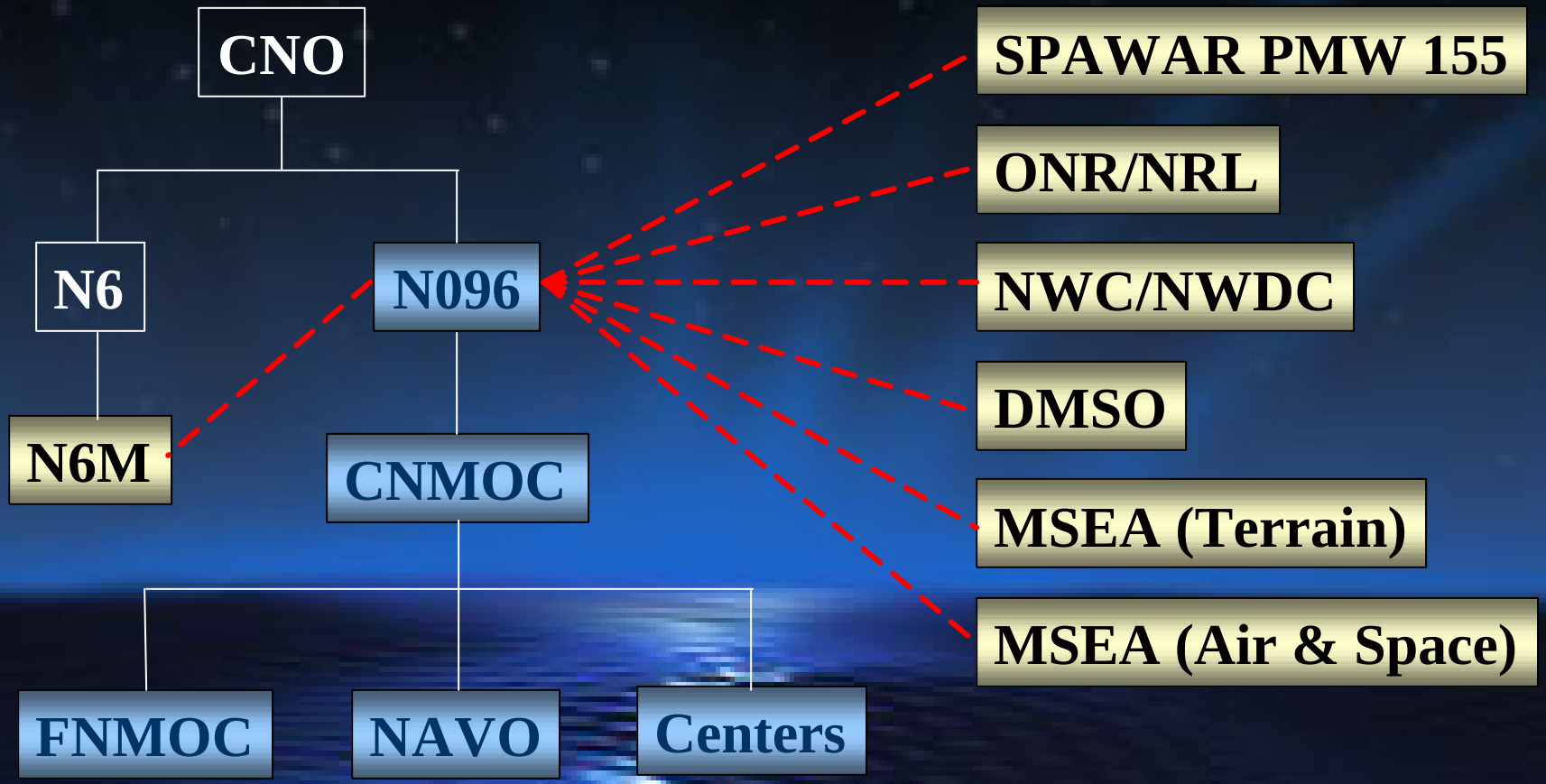
As stated in the Navy's M&S Master Plan:

"Ensure that authoritative representations of the ocean environment are defined and accessible to the DoD M&S analysis, acquisition, and training communities."

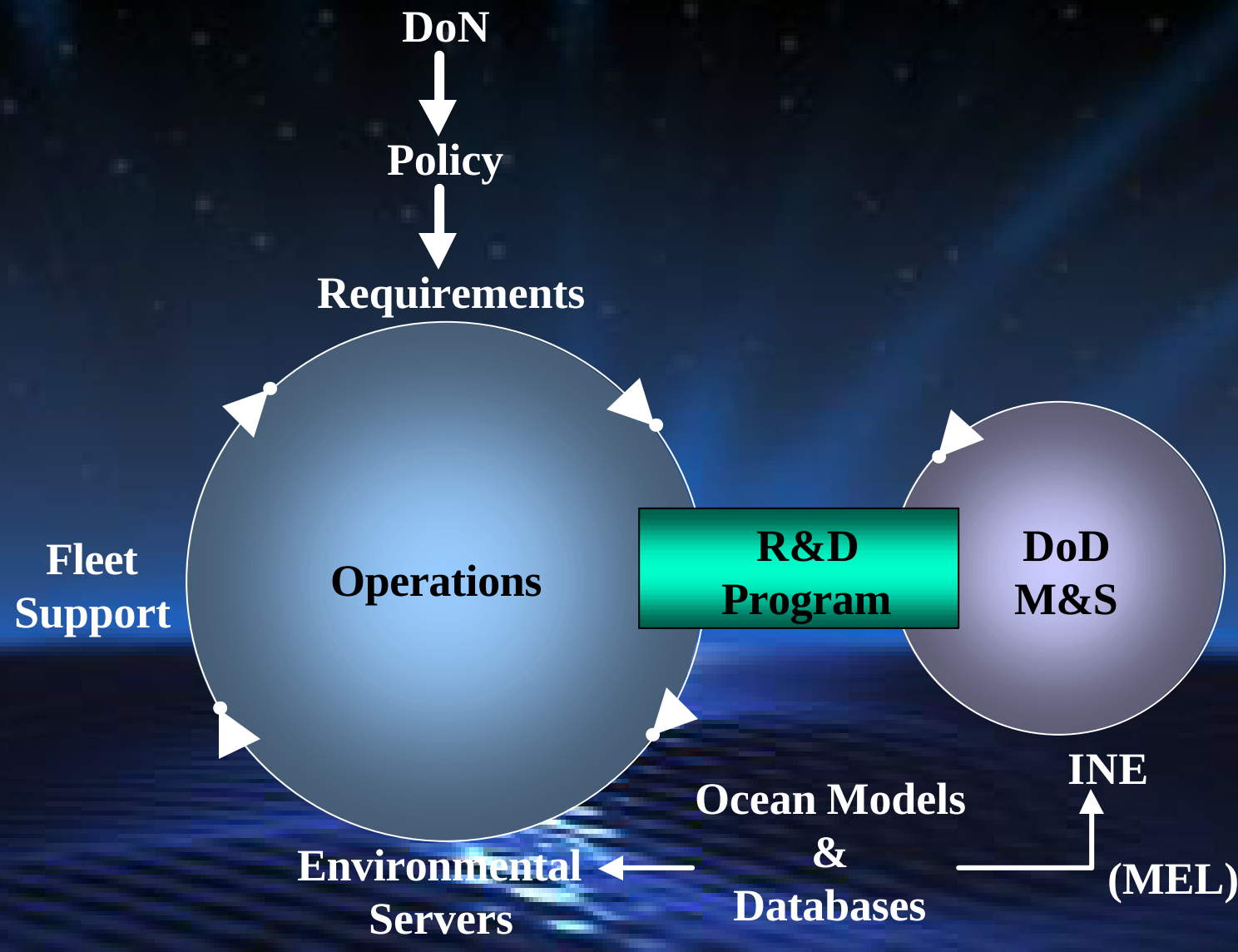
MSEA Role

- Facilitator in the project startup phase
- Catalyst during development
- Certifier in the capability delivery/migration phase of a simulation.

Our Extended M&S Organization

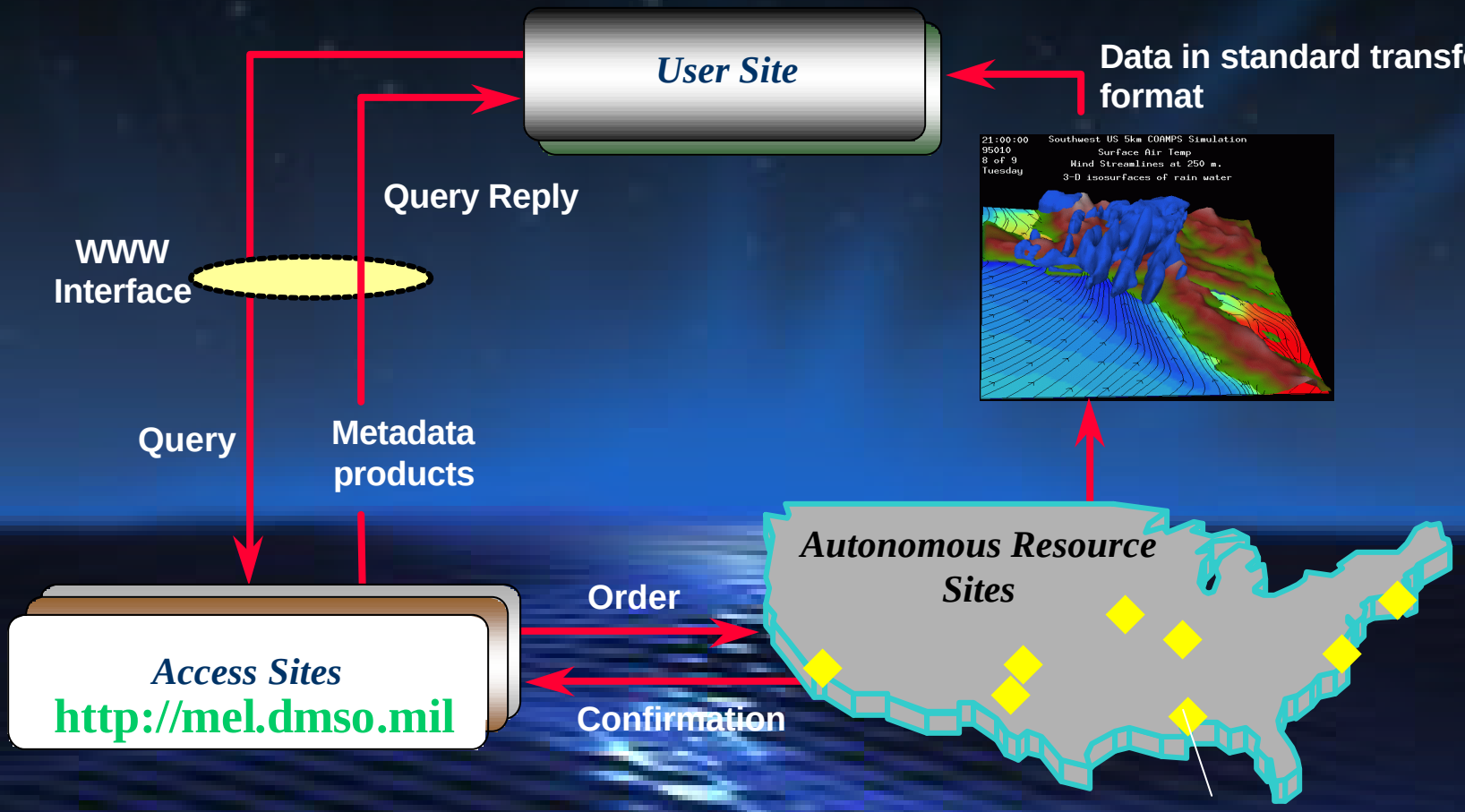


Operational Concept



Master Environmental Library (MEL)

Challenge: Facilitate discovery, access, subscription, and delivery of environmental informati on, products, and data wherever they are stored.



Naval Oceanographic Office

Ocean and Atmospheric Master Library

- **Navy Standard** library of models, algorithms and databases for use in operational METOC prediction systems.
- 59 configure-managed items are available:
  - 19 Data Bases
  - 33 Models
  - 7 Algorithms
- 34 more approved for development
- Independent model and database V&V panels

OAML Library Items

OCEAN MODELS
MODAS 1.0
Naval Search and Rescue 1.0
Surf Prediction 3.0
Shallow Water REF/DIF 1.0

OCEAN DATA BASES
GDEM PROV. 4.0
ICECAP 2.0
Historical Temporal Shipping-V 1.1
GDEM-V 2.5
GDEM-Province 4.0

SENSOR SPECIFIC DATA BASES
VLAD NOISE GAIN 2.0

GI&S PRODUCTS (Digital Bathy)
DBDB-V Ver 3.0

ACOUSTIC MODELS
Parabolic Equation 5.0
ASTRAL 5.0
ASPM 4.3
Gaussian Ray Bundle 1.0
High Freq Env Acoustic (HFEVA) 1.0
COLOSSUS II 1.0
Low Freq Bottom LOSS 2.4 (LFBLTAB)
Surface LOSS 2.0
System LOSS 1.0
Active LOSS 2.0
CASTAR 1.0
CASS 3.0

ACOUSTIC DATA BASES
High Freq BL 2.1
Low Freq BL 9.1
Consolidated BLUG 1.1

Vol Scattering Strength 6.2
Wind & Residual Noise 2.1
Shipping Noise 5.2

OAML Library Items

ATMOSPHERIC MODELS

MUF 1.1
LUF 1.1
EDH 1.0
RFSDR 1.0
CLUTTER 1.1
STD EM PROP. 1.0
SSR 1.0
RADFO 1.0
FLIR 2.0
CHAFF TRAJ. 1.0
CHAFF DISP. 1.0
METBAL 1.0
RPO 1.16
RIA 1.0
MVOI 1.0
VLSTRACK 2.0

ATMOSPHERIC DATABASES

HEPC 1.0
UAGC 1.1
GTCT 1.0
NHECT 1.0
SMGC 1.0

ALGORITHMS

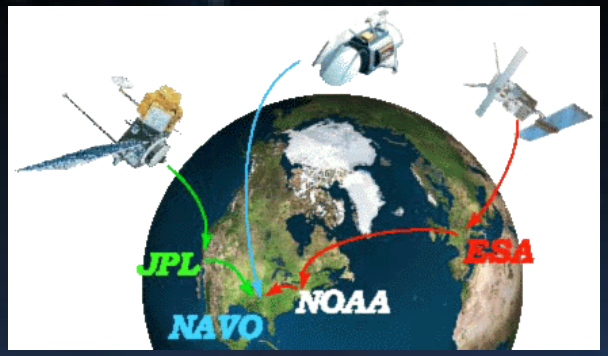
SLAC 3.0
Wilson Sound Speed 1.0
TEMP/UTIL 1.0
D-Values 1.0
PADA 1.0
Surface Scattering Strength 1.0

M&S Issues

- Rapid Data Assimilation in M&S
- Surf models for shallow water special operations
- A nesting of ocean-related models and products
- Timely demonstrations to assess progress/effectiveness

Rapid Data Assimilation in M&S

(Same as for Operations)



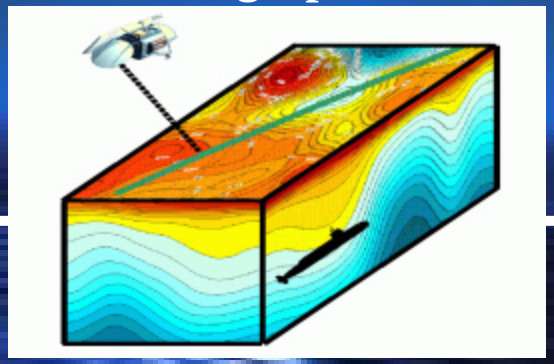
Remote Sensors

- MCSST & Altimetry
- Air, Buoy, & Ship XBTs
- Through-the-Sensor

NAVOCEANO

Global Data Fusion

Compressed
Oceanographic Data



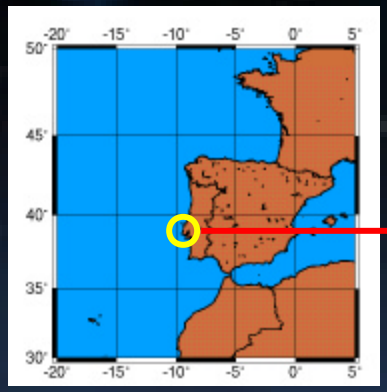
METOC Centers

Regional Fusion &Tailored
Operational Support

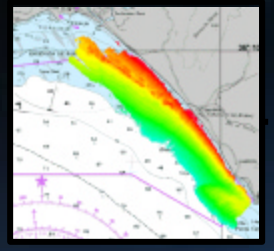
Local XBT Measurements

Integrated Wave to Surf Modeling

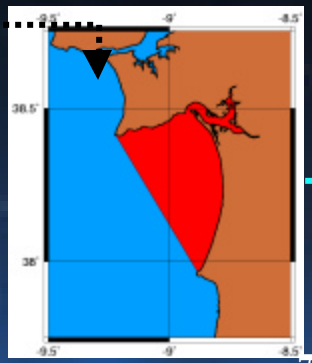
WAVE MODELS



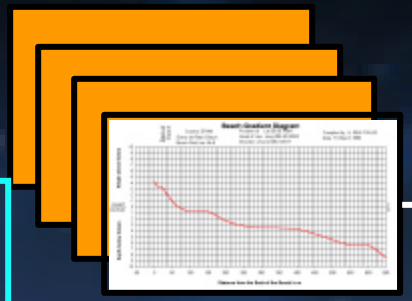
Bathymetry



WAVE REFRACTION MODEL (REF/DIF1)

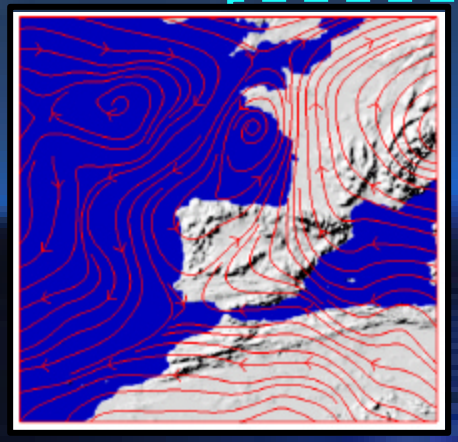


Beach Profile Data



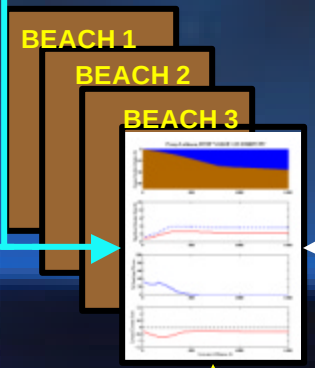
Deep-water Wave Spectra

Wind Stress



Wind Stress

Refracted Wave Spectra



WIND-DRIVEN TIDES

COAMPS

ADCIRC or PCTIDES
(fixed) (relocatable)

SURF FORECASTS
(TEXT, GIFS)

Distributed Integrated Ocean Prediction System (DIOPS 1.0)

Beach Profiles

- **Navy SEAL Team Survey**
- **Constant slope**
- **Sediment-based**
- **REA (SHOALS etc.)**
- **Blended**

Winds

- **COAMPS**
- **Other**

Shallow-Water Directional Wave Spectra

- **STWAVE**
- **REFDIF**

Tides

- **ADCIRC**
- **PC-TIDES**
- **Tide Tables**

SURF3.0

SURF 3.0 OUTPUT:

- Significant wave height
- Significant breaker height
- Peak period, Breaker period
- Breaker Type:
  - Spilling
  - Plunging
  - Surging
- Breaker Angle
- Surf Zone Width
- Longshore Current
- Modified Surf Index

Nesting of Ocean-related Models and Products

Telescoping Strategy

Global/Mesoscale/Tactical/Nowcast Scales

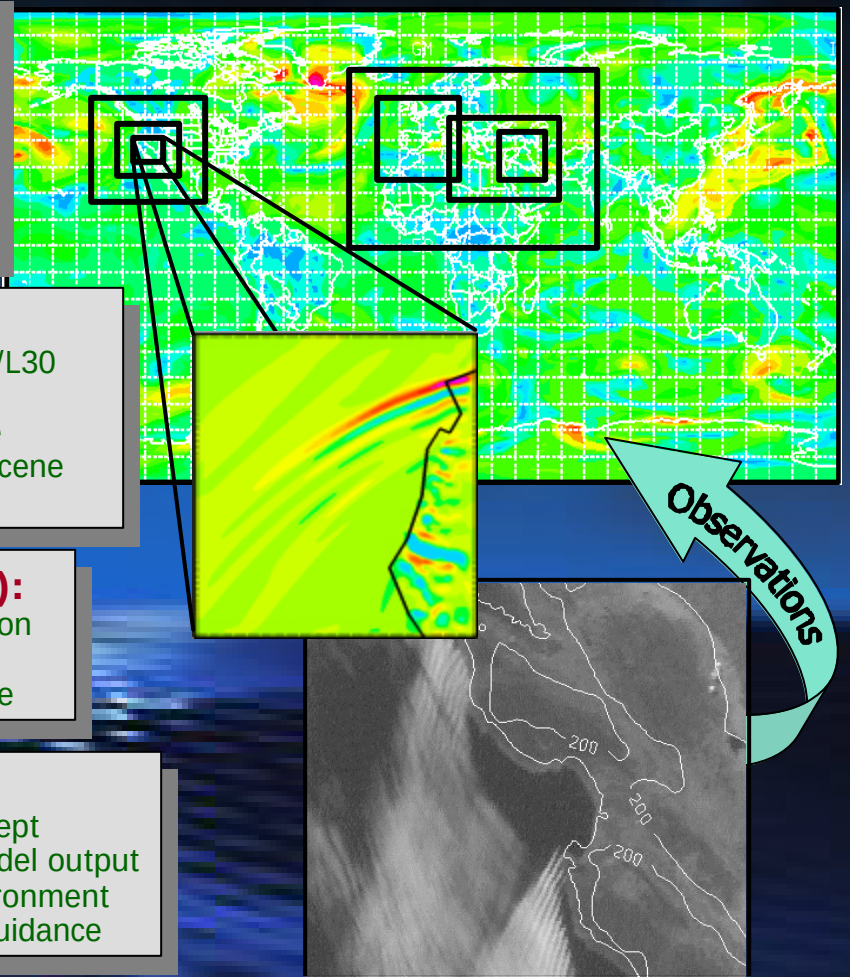
NOGAPS:
- FNMOC spectral model, T239/L36*
- Data assimilation; 0-10 day guidance
- Provides boundary conditions for COAMPS coarse mesh

* Scheduled for FY02

COAMPS:
- FNMOC nonhydrostatic model, <9 km/L30
- Globally relocatable; Data assimilation
- Explicit moist physics; 0-72h guidance
- Provides boundary conditions for on-scene COAMPS coarse mesh

TAMS/RT (6.4) / (DAMPS):
- On-scene tactical data assimilation
- COAMPS, METOC database, GUI
- Tactical weather; 0-48h guidance

NOWCAST (6.2):
- Battlegroup mesonet concept
- Fuse observations and model output
- Common battlespace environment
- Tactical end users; 0-6h guidance



Timely Demonstrations to Test Progress

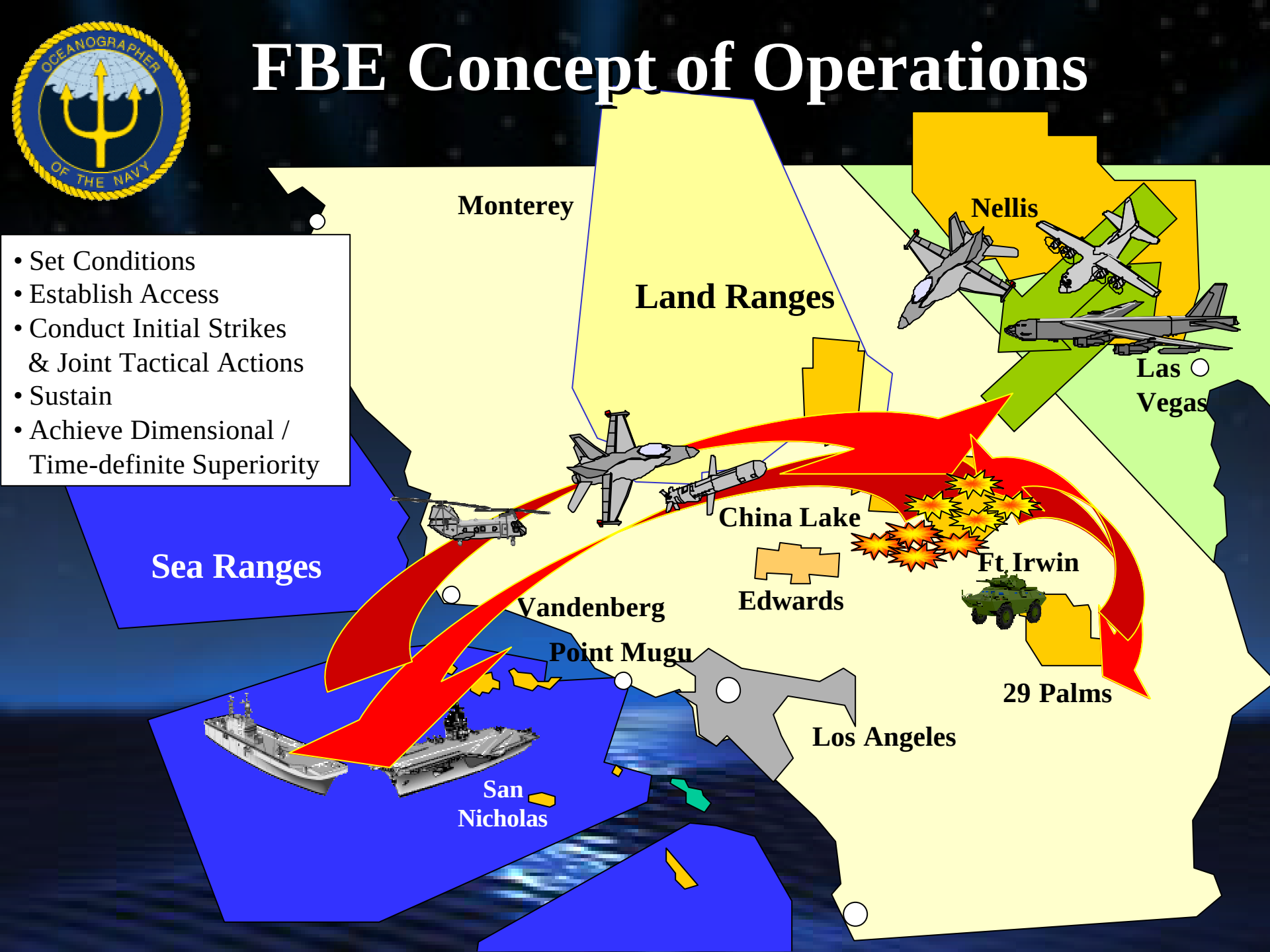
NWDC M&S Objective

To create a condition/state where novel concepts involving C2 architectures, organizations, and technologies can be end-to-end and repeatedly stimulated in a robust and scalable manner for FBEs and Laboratory Experiments.

Directly relates to the direction, management of information flow to critical nodes of war fighting decision makers

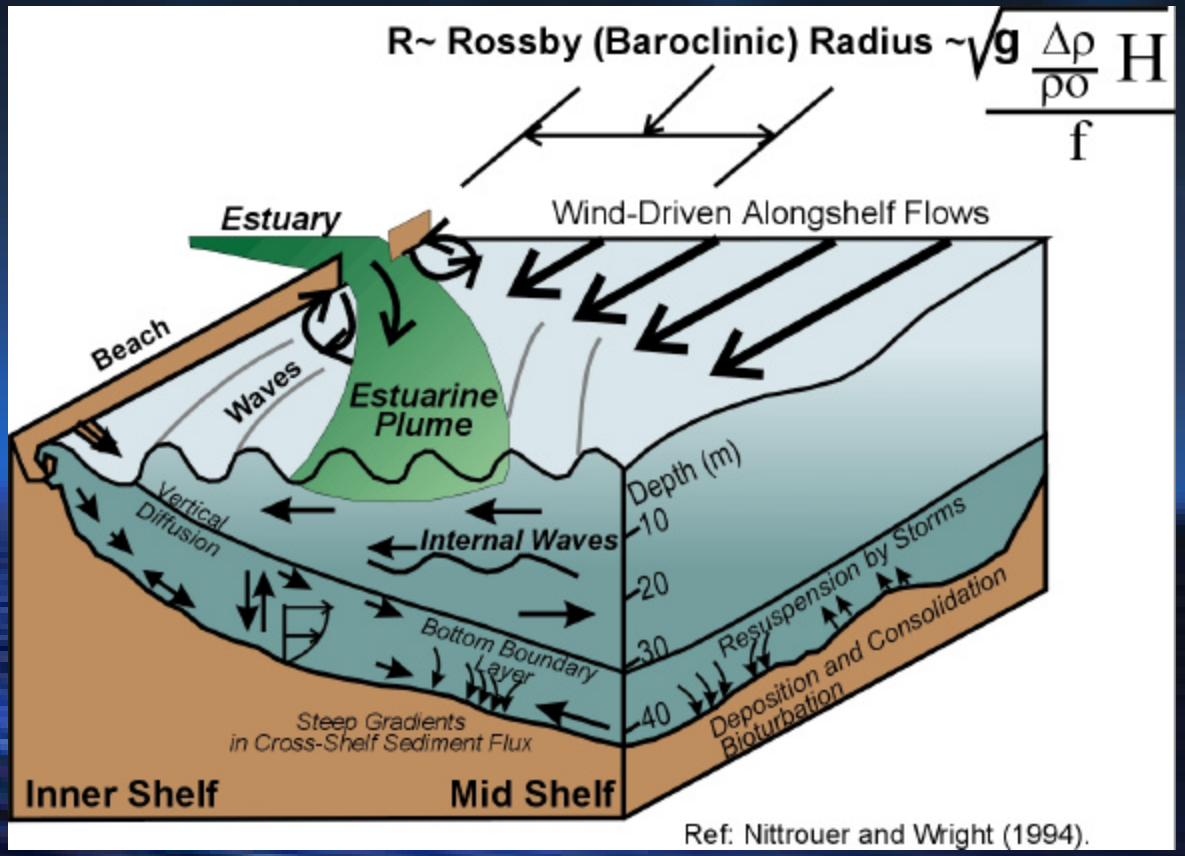
FBE Concept of Operations

- Set Conditions
- Establish Access
- Conduct Initial Strikes & Joint Tactical Actions
- Sustain
- Achieve Dimensional / Time-definite Superiority



Assessing Model Effectiveness

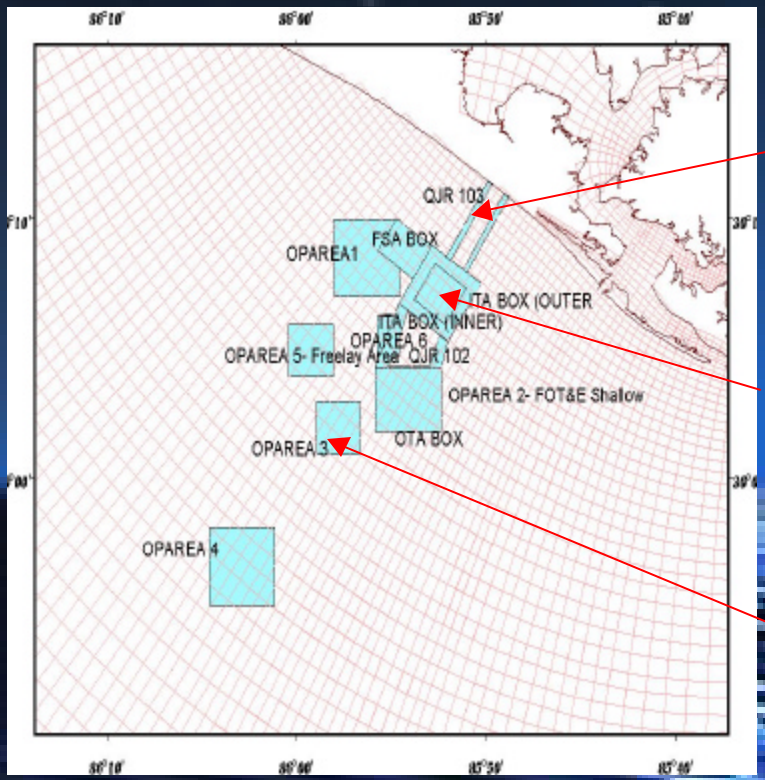
- A Problem of Time: Refresh rates.
  - Littoral Ocean Regions are characterized by long and short term factors, but unlike the deep water, short term effects are more significant
- A Problem of Space
  - Rapid changes in bottom slopes create the need for non-uniform grids



Ocean Sensitivity Study

Gulf of Mexico

Aug 29 to Sept 3, 1999

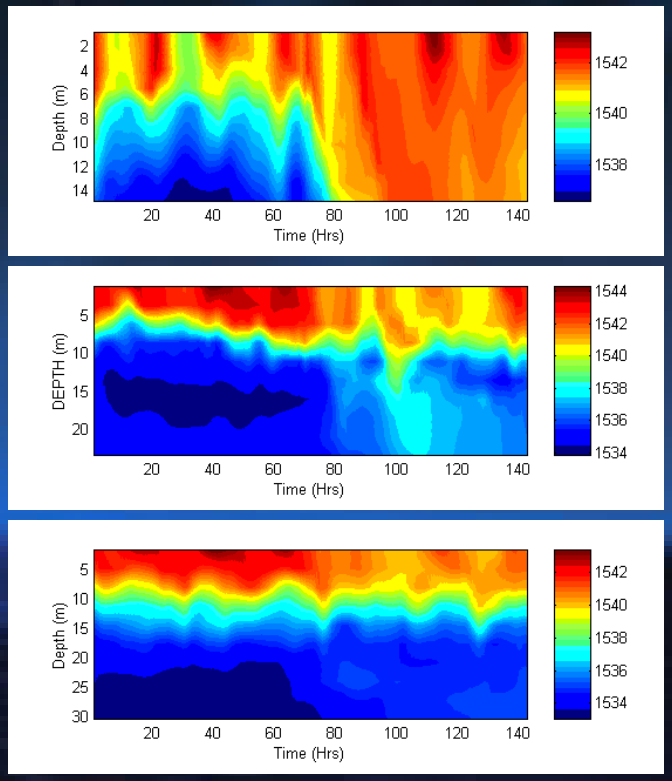


QJR 103

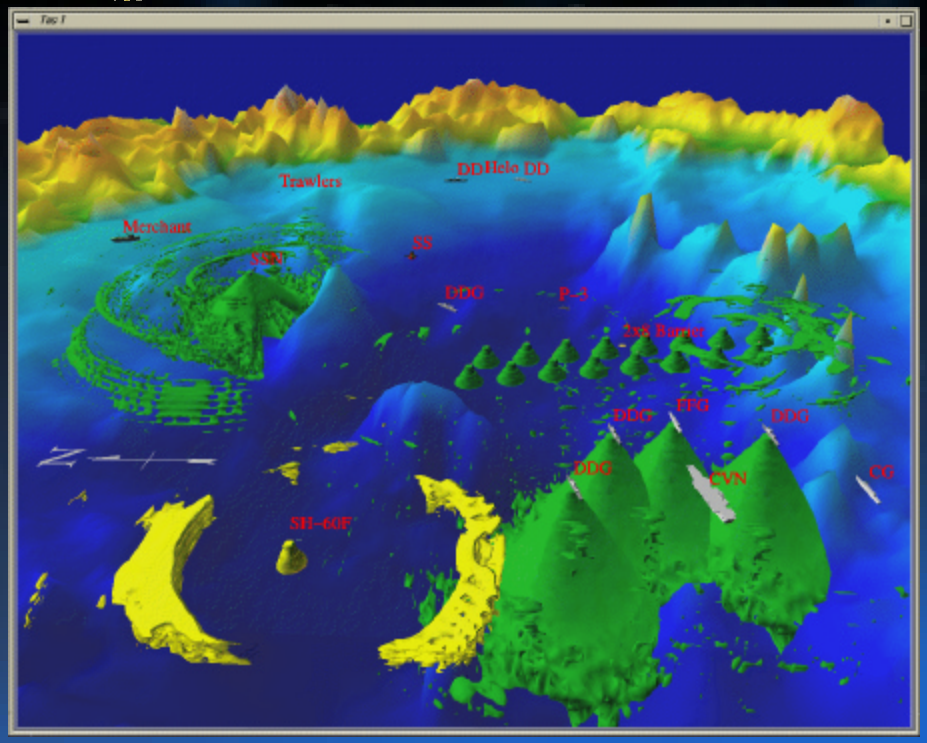
ITA Box Inner

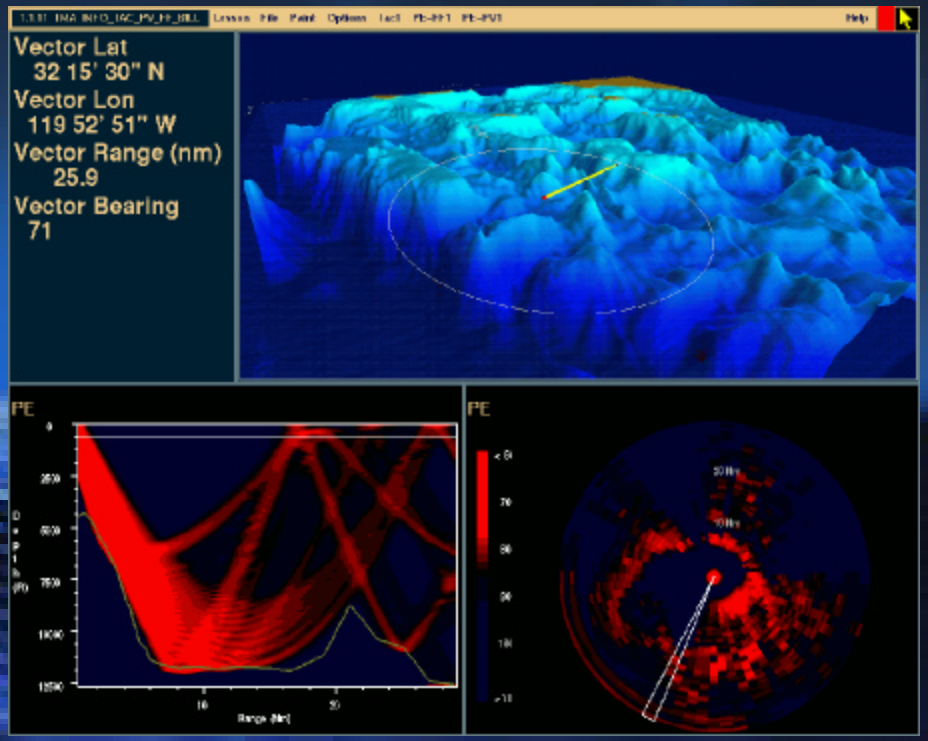
OPAREA 3

Sound Speed

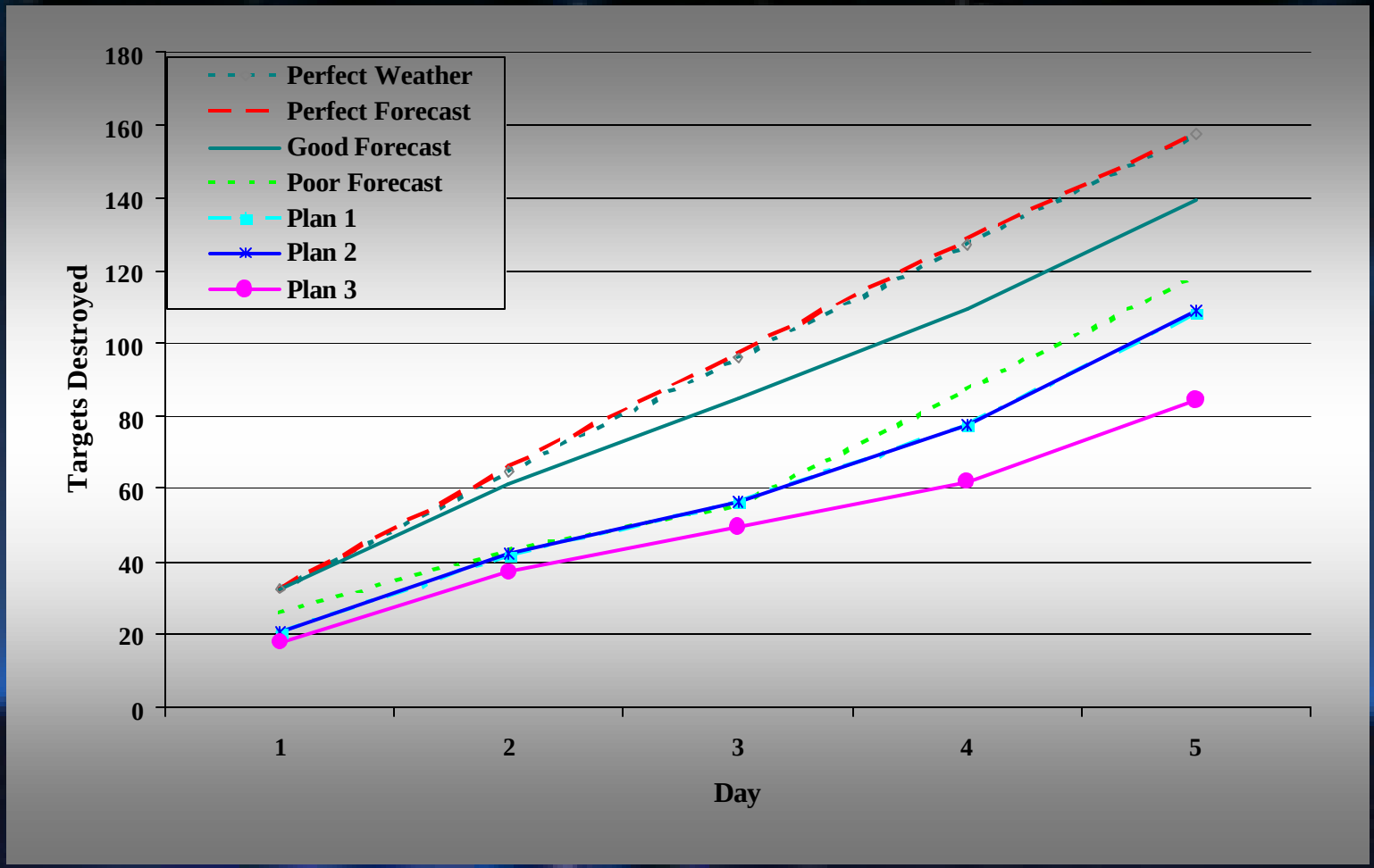


Effectiveness of M&S





Environmental Impact



- Developed weather pattern – clouds, ceiling, visibility, precip, temp.
- Modeled weather, impact on flights & available targets.
- Results: targets destroyed and risk to aircraft.

The Way Ahead in Ocean M&S

- **Display technologies**
- **Sensitivity to the environment**
  - Sensitivity studies
  - Impact studies and products
- **Data acquisition**
- **Resolution**
  - Space and time

Industry's Role

- Rapid Environmental Assessment
- Sensor Development / Integration
- Through the Sensor Technologies
- Information Fusion

Contact Information

Policy

Tom Cuff
202-762-0251
cuff.thomas@hq.navy.mil

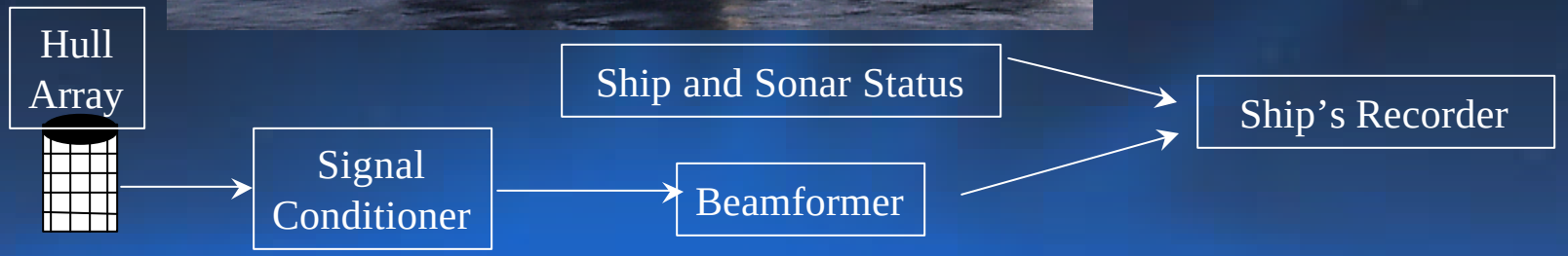
Technical

Ed Weitzner
202-762-0264
weitzner.edward@hq.navy.mil

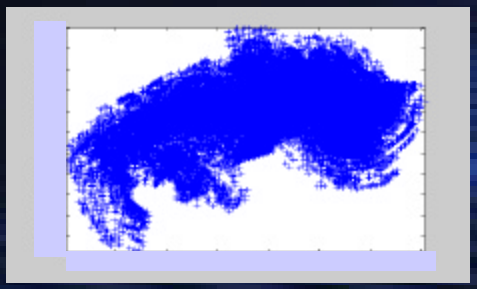
Back Up Slides

Through the Sensor Data Collection

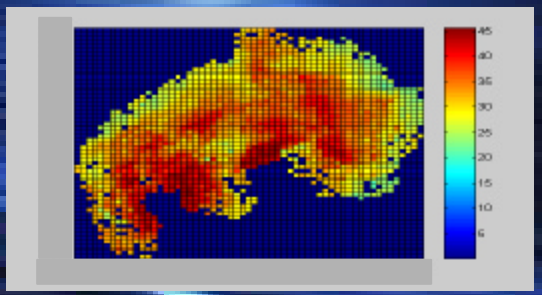
SABLE currently processes recorded active sonar returns from the AN/SQS-53C sonar.



Database Filtering



Reverberation



Scattering Strength